

# Change Pages for the Stormwater Management Manual 2012 Edition

**Revision Date: August 27, 2013**

Please reference the following pages for recent changes or corrections to the information presented in the manual.

**Changes included:**

***Glossary pages G-5, G-32 to G-46*** – Added definitions for Bituminous surface treatment and New Impervious Surface. Shifted the glossary to account for the new definitions.

***Volume 3, Chapter 2, page 3-6*** – Modified Section 2.2 to clarify the selection of roof downspout controls.

***Volume 3, Chapter 2, page 3-13*** – Modified Table 3 – 5 Downspout Infiltration Length for USDA Soil Type with measurements.

<b>Biochemical oxygen demand (BOD)</b>	An indirect measure of the concentration of biologically degradable materials present in organic wastes. The amount of free oxygen utilized by aerobic organisms when allowed to attack the organic material in an aerobically maintained environment at a specified temperature (20°C) for a specific time period (5 days), and thus stated as BOD5. It is expressed in milligrams of oxygen utilized per liter of liquid waste volume (mg/l) or in milligrams of oxygen per kilogram of waste solution (mg/kg = ppm = parts per million parts). Also called biological oxygen demand.
<b>Biodegradable</b>	Capable of being readily broken down by biological means, especially by microbial action. Microbial action includes the combined effect of bacteria, fungus, flagellates, amoebae, ciliates, and nematodes. Degradation can be rapid or may take many years depending upon such factors as available oxygen and moisture.
<b>Bioengineering</b>	The combination of biological, mechanical, and ecological concepts (and methods) to control erosion and stabilize soil through the use of vegetation or in combination with construction materials.
<b>Biofilter</b>	A designed treatment facility using a combined soil and vegetation system for filtration, infiltration, adsorption, and biological uptake of pollutants in stormwater when runoff flows over and through. Vegetation growing in these facilities acts as both a physical filter which causes gravity settling of particulates by regulating velocity of flow, and also as a biological sink when direct uptake of dissolved pollutants occurs. The former mechanism is probably the most important in western Washington where the period of major runoff coincides with the period of lowest biological activity.
<b>Biofiltration</b>	The process of reducing pollutant concentrations in water by filtering the polluted water through biological materials.
<b>Biological control</b>	A method of controlling pest organisms by means of introduced or naturally occurring predatory organisms, sterilization, the use of inhibiting hormones, or other means, rather than by mechanical or chemical means.
<b>Biological magnification</b>	The increasing concentration of a substance along succeeding steps in a food chain. Also called biomagnification.
<b>Bituminous surface treatment (“chip seal”)</b>	A temporary surface treatment provided to control dust and assist in the control of erosion. An unimproved roadway that receives this treatment does not meet the City of Tacoma Standard Roadway Design
<b>Bollard</b>	A post (may or may not be removable) used to prevent vehicular access.

<b>New Impervious Surface</b>	<p>Creation of an impervious surface, including</p> <ul style="list-style-type: none"> <li>• Extending the pavement edge without increasing the size of the road prism</li> <li>• Paving gravel shoulders</li> <li>• Upgrading from dirt to gravel, asphalt, or concrete</li> <li>• Upgrading from gravel to asphalt or concrete</li> <li>• Upgrading from bituminous surface treatment (“chip seal”) to asphalt or concrete (Bituminous Surface Treatment Policy memo, dated June 19 2013)</li> </ul> <p>On redevelopment sites, the following apply</p> <ul style="list-style-type: none"> <li>• For structures, the construction of a structure over an existing asphalt or concrete surface will not be considered new or replaced impervious surfaces and will not be counted toward project thresholds if the existing underlying impervious surface remains in place</li> <li>• Asphalt or concrete overlays will not be considered new or replaced impervious surface and will not be counted toward project thresholds.</li> </ul>
<b>Nitrate (NO<sub>3</sub>)</b>	A form of nitrogen which is an essential nutrient to plants. It can cause algal blooms in water if all other nutrients are present in sufficient quantities. It is a product of bacterial oxidation of other forms of nitrogen, from the atmosphere during electrical storms and from fertilizer manufacturing.
<b>Nitrification</b>	The biochemical oxidation process by which ammonia is changed first to nitrites and then to nitrates by bacterial action, consuming oxygen in the water.
<b>Nitrogen, Available</b>	Usually ammonium, nitrite, and nitrate ions, and certain simple amines available for plant growth. A small fraction of organic or total nitrogen in the soil is available at any time.
<b>Nonpoint source pollution</b>	Pollution that enters a waterbody from diffuse origins on the watershed and does not result from discernible, confined, or discrete conveyances.
<b>Normal depth</b>	The depth of uniform flow. This is a unique depth of flow for any combination of channel characteristics and flow conditions. Normal depth is calculated using Manning's Equation.
<b>NRCS Method</b>	See SCS Method.
<b>Nutrients</b>	Essential chemicals needed by plants or animals for growth. Excessive amounts of nutrients can lead to degradation of water quality and algal blooms. Some nutrients can be toxic at high concentrations.
<b>Off-line facilities</b>	Water quality treatment facilities to which stormwater runoff is restricted to some maximum flow rate or volume by a flow-splitter.

<b>Offsite drainage</b>	Any area lying upstream of the site that drains onto the site and any area lying downstream of the site to which the site drains.
<b>Off-system storage</b>	Facilities for holding or retaining excess flows over and above the carrying capacity of the stormwater conveyance system, in chambers, tanks, lagoons, ponds, or other basins that are not a part of the subsurface sewer system.
<b>Oil/water separator</b>	A vault, usually underground, designed to provide a quiescent environment to separate oil from water.
<b>On-line facilities</b>	Water quality treatment facilities which receive all of the stormwater runoff from a drainage area. Flows above the water quality design flow rate or volume are passed through at a lower percent removal efficiency.
<b>Onsite drainage</b>	Drainage originating within the site.
<b>Onsite Stormwater Management BMPs</b>	Site development techniques that serve to infiltrate, disperse, and retain stormwater runoff on-site.
<b>Operational BMPs</b>	Operational BMPs are a type of Source Control BMP. They are schedules of activities, prohibition of practices, and other managerial practices to prevent or reduce pollutants from entering stormwater. Operational BMPs include formation of a pollution prevention team, good housekeeping, preventive maintenance procedures, spill prevention and clean-up, employee training, inspections of pollutant sources and BMPs, and record keeping. They can also include process changes, raw material/product changes, and recycling wastes.
<b>Ordinary high water mark</b>	<p>The term ordinary high water mark means the line on the shore established by the fluctuations of water and indicated by physical characteristics such as a clear, natural line impressed on the bank; shelving; changes in the character of soil destruction on terrestrial vegetation, or the presence of litter and debris; or other appropriate means that consider the characteristics of the surrounding area.</p> <p>The ordinary high water mark will be found by examining the bed and banks of a stream and ascertaining where the presence and action of waters are so common and usual, and so long maintained in all ordinary years, as to mark upon the soil a character distinct from that of the abutting upland, in respect to vegetation. In any area where the ordinary high water mark cannot be found, the line of mean high water shall substitute. In any area where neither can be found, the channel bank shall be substituted. In braided channels and alluvial fans, the ordinary high water mark or substitute shall be measured so as to include the entire stream feature.</p>

<b>Organic matter</b>	Organic matter as decomposed animal or vegetable matter. It is measured by ASTM D 2974. Organic matter is an important reservoir of carbon and a dynamic component of soil and the carbon cycle. It improves soil and plant efficiency by improving soil physical properties including drainage, aeration, and other structural characteristics. It contains the nutrients, microbes, and higher-form soil food web organisms necessary for plant growth. The maturity of organic matter is a measure of its beneficial properties. Raw organic matter can release water-soluble nutrients (similar to chemical fertilizer). Beneficial organic matter has undergone a humification process either naturally in the environment or through a composting process.
<b>Orifice</b>	An opening with closed perimeter, usually sharp-edged, and of regular form in a plate, wall, or partition through which water may flow, generally used for the purpose of measurement or control of water.
<b>Outlet</b>	Point of water disposal from a stream, river, lake, tidewater, or artificial drain.
<b>Outlet channel</b>	A waterway constructed or altered primarily to carry water from man-made structures, such as terraces, tile lines, and diversions.
<b>Outwash soils</b>	Soils formed from highly permeable sands and gravels.
<b>Overflow</b>	A device that allows the portion of flow above which can be handled to discharge downstream.
<b>Overflow rate</b>	Detention basin release rate divided by the surface area of the basin. It can be thought of as an average flow rate through the basin.
<b>Overtopping</b>	To flow over the limits of a containment or conveyance element.
<b>Particle Size</b>	The effective diameter of a particle as measured by sedimentation, sieving, or micrometric methods.
<b>Peak discharge</b>	The maximum instantaneous rate of flow during a storm, usually in reference to a specific design storm event.
<b>Peak-shaving</b>	Controlling post-development peak discharge rates to pre-development levels by providing temporary detention in a BMP.
<b>Percolation</b>	The movement of water through soil.
<b>Percolation rate</b>	The rate, often expressed in minutes/inch, at which clear water, maintained at a relatively constant depth, will seep out of a standardized test hole that has been previously saturated. The term percolation rate is often used synonymously with infiltration rate (short-term infiltration rate).

<b>Permanent Stormwater Control (PSC) Plan</b>	A plan which includes permanent BMPs for the control of pollution from stormwater runoff after construction and/or land disturbing activity has been completed.
<b>Permeable soils</b>	Soil materials with a sufficiently rapid infiltration rate so as to greatly reduce or eliminate surface and stormwater runoff. These soils are generally classified as SCS hydrologic soil types A and B.
<b>Person</b>	Any individual, partnership, corporation, association, organization, cooperative, public or municipal corporation, agency of the state, or local government unit, however designated.
<b>Perviousness</b>	Related to the size and continuity of void spaces in soils; related to a soil's infiltration rate.
<b>Pesticide</b>	A general term used to describe any substance - usually chemical - used to destroy or control organisms; includes herbicides, insecticides, algicides, fungicides, and others. Many of these substances are manufactured and are not naturally found in the environment. Others, such as pyrethrum, are natural toxins that are extracted from plants and animals.
<b>pH</b>	A measure of the alkalinity or acidity of a substance which is conducted by measuring the concentration of hydrogen ions in the substance. A pH of 7.0 indicates neutral water. A 6.5 reading is slightly acid.
<b>Physiographic</b>	Characteristics of the natural physical environment (including hills).
<b>Plan Approval Authority</b>	The Plan Approval Authority is defined as that department within a local government that has been delegated authority to approve stormwater site plans.
<b>Planned unit development (PUD)</b>	A special classification authorized in some zoning ordinances, where a unit of land under control of a single developer may be used for a variety of uses and densities, subject to review and approval by the local governing body. The locations of the zones are usually decided on a case-by-case basis.
<b>Plat</b>	A map or representation of a subdivision showing the division of a tract or parcel of land into lots, blocks, streets, or other divisions and dedications.
<b>Plunge pool</b>	A device used to dissipate the energy of flowing water that may be constructed or made by the action of flowing. These facilities may be protected by various lining materials.
<b>Point discharge</b>	The release of collected and/or concentrated surface and stormwater runoff from a pipe, culvert, or channel.

<b>Point of compliance</b>	The location at which compliance with a discharge performance standard or a receiving water quality standard is measured.
<b>Pollution</b>	Contamination or other alteration of the physical, chemical, or biological properties, of waters of the state, including change in temperature, taste, color, turbidity, or odor of the waters, or such discharge of any liquid, gaseous, solid, radioactive or other substance into any waters of the state as will or is likely to create a nuisance or render such waters harmful, detrimental or injurious to the public health, safety or welfare, or to domestic, commercial, industrial, agricultural, recreational, or other legitimate beneficial uses, or to livestock, wild animals, birds, fish or other aquatic life.
<b>Pollution-generating impervious surface (PGIS)</b>	<p>Those impervious surfaces considered to be a significant source of pollutants in stormwater runoff. Such surfaces include those which are subject to: vehicular use; industrial activities (as further defined in this glossary); or storage of erodible or leachable materials, wastes, or chemicals, and which receive direct rainfall or the run-on or blow-in of rainfall. Erodible or leachable materials, wastes, or chemicals are those substances which, when exposed to rainfall, measurably alter the physical or chemical characteristics of the rainfall runoff. Examples include erodible soils that are stockpiled, uncovered process wastes, manure, fertilizers, oily substances, ashes, and kiln dust. Metal roofs are also considered to be PGIS unless they are coated with an inert, non-leachable material (e.g., baked-on enamel coating).</p> <p>A surface, whether paved or not, shall be considered subject to vehicular use if it is regularly used by motor vehicles. The following are considered regularly-used surfaces: roads, non-vegetated road shoulders, bike lanes within the traveled lane of a roadway, driveways, parking lots, unfenced fire lanes, vehicular equipment storage yards, and airport runways.</p> <p>The following are not considered regularly-used surfaces: paved bicycle pathways separated from and not subject to drainage from roads for motor vehicles, fenced fire lanes, and infrequently used maintenance access roads.</p>
<b>Pollution-generating pervious surface (PGPS)</b>	Any non-impervious surface subject to use of pesticides and fertilizers or loss of soil. Typical PGPS include lawns, landscaped areas, golf courses, parks, cemeteries, and sports fields
<b>Predeveloped Condition</b>	The native vegetation and soils that existed at a site prior to the influence of Euro-American settlement. The pre-developed condition shall be assumed to be forested land cover unless reasonable, historic information is provided that indicates the site was prairie prior to settlement.

<b>Prediction</b>	For the purposes of this document an expected outcome based on the results of hydrologic modeling and/or the judgment of a trained professional civil engineer or geologist.
<b>Pretreatment</b>	The removal of material such as solids, grit, grease, and scum from flows prior to physical, biological, or physical treatment processes to improve treatability. Pretreatment may include screening, grit removal, settling, oil/water separation, or application of a Basic Treatment BMP prior to infiltration.
<b>Priority peat systems</b>	Unique, irreplaceable fens that can exhibit water pH in a wide range from highly acidic to alkaline, including fens typified by Sphagnum species, <u>Ledum groenlandicum</u> (Labrador tea), <u>Drosera rotundifolia</u> (sundew), and <u>Vaccinium oxycoccos</u> (bog cranberry); marl fens; estuarine peat deposits; and other moss peat systems with relatively diverse, undisturbed flora and fauna. Bog is the common name for peat systems having the Sphagnum association described, but this term applies strictly only to systems that receive water income from precipitation exclusively.
<b>Professional civil engineer</b>	A person registered with the state of Washington as a professional engineer in civil engineering.
<b>Project</b>	Any proposed action to alter or develop a site. The proposed action of a permit application or an approval, which requires drainage review.
<b>Project site</b>	That portion of a property, properties, or right of way subject to land disturbing activities, new impervious surfaces, or replaced impervious surfaces. On-site and associated off-site improvements shall be added together when determining if a project site exceeds a threshold. Environmental Services shall make the final determination of the project site.
<b>Properly Functioning Soil System (PFSS)</b>	Equivalent to engineered soil/landscape system. This can also be a natural system that has not been disturbed or modified.
<b>Puget Sound basin</b>	Puget Sound south of Admiralty Inlet (including Hood Canal and Saratoga Passage); the waters north to the Canadian border, including portions of the Strait of Georgia; the Strait of Juan de Fuca south of the Canadian border; and all the lands draining into these waters as mapped in Water Resources Inventory Areas numbers 1 through 19, set forth in WAC 173-500-040.
<b>R/D</b>	See retention/detention facility.



<b>Rare, threatened, or endangered species</b>	Plant or animal species that are regional relatively uncommon, are nearing endangered status, or whose existence is in immediate jeopardy and is usually restricted to highly specific habitats. Threatened and endangered species are officially listed by federal and state authorities, whereas rare species are unofficial species of concern that fit the above definitions.
<b>Rational method</b>	A means of computing storm drainage flow rates (Q) by use of the formula $Q = CIA$ , where C is a coefficient describing the physical drainage area, I is the rainfall intensity and A is the area.
<b>Reach</b>	A length of channel with uniform characteristics.
<b>Receiving waters</b>	Bodies of water or surface water systems to which surface runoff is discharged via a point source of stormwater or via sheet flow.
<b>Recharge</b>	The addition of water to the zone of saturation (i.e., an aquifer).
<b>Recommended BMPs</b>	As used in Volume 4, recommended BMPs are those BMPs that are not expected to be mandatory by local governments at new development and redevelopment sites. However, they may improve pollutant control efficiency, and may provide a more comprehensive and environmentally effective stormwater management program.
<b>Redevelopment</b>	On a site that is already substantially developed (has 35% or more of existing impervious surface coverage): <ul style="list-style-type: none"> <li>• The creation or addition of impervious surfaces</li> <li>• The expansion of a building footprint or addition or replacement of a structure</li> <li>• Structural development including construction, installation or expansion of a building or other structure</li> <li>• Replacement of impervious surface that is not part of a routine maintenance activity</li> <li>• Land disturbing activities</li> </ul>
<b>Regional</b>	An action (here, for stormwater management purposes) that involves more than one discrete property.
<b>Regional stormwater facility</b>	A stormwater facility designed to correct existing surface water runoff problems of a basin or sub-basin.
<b>Release rate</b>	The computed peak rate of surface and stormwater runoff from a site.

<b>Removed impervious surface</b>	Areas where the impervious surface covering (i.e. building, pavement, gravel, etc.) has been removed, the soil has been amended in accordance with the BMP L613 (Volume 3, Section 4.1) and the area is left as a permanent pervious surface (landscaping, natural areas) and planted with native vegetation including evergreen trees. Removed impervious surfaces are not required to be added to the impervious area totals to determine compliance with Minimum Requirements #6, #7 and #8.
<b>Replaced impervious surface</b>	For structures, the removal and replacement of any exterior impervious surfaces or foundation. For other impervious surfaces, the removal down to bare soil or base course, or repairing the base and replacement.
<b>Residential</b>	Single family residences, duplexes and triplexes.
<b>Residential density</b>	The number of dwelling units per unit of surface area. Net density includes only occupied land. Gross density includes unoccupied portions of residential areas, such as roads and open space.
<b>Restoration</b>	Actions performed to reestablish wetland functional characteristics and processes that have been lost by alterations, activities, or catastrophic events in an area that no longer meets the definition of a wetland
<b>Retention</b>	The process of collecting and holding surface and stormwater runoff with no surface outflow.
<b>Retention/detention facility (R/D)</b>	A type of drainage facility designed either to hold water for a considerable length of time and then release it by evaporation, plant transpiration, and/or infiltration into the ground; or to hold surface and stormwater runoff for a short period of time and then release it to the surface and stormwater management system.
<b>Retrofitting</b>	The renovation of an existing structure or facility to meet changed conditions or to improve performance.
<b>Return frequency</b>	A statistical term for the average time of expected interval that an event of some kind will equal or exceed given conditions (e.g., a stormwater flow that occurs every 2 years)
<b>Rhizome</b>	A modified plant stem that grows horizontally underground.
<b>Riffles</b>	Fast sections of a stream where shallow water races over stones and gravel. Riffles usually support a wider variety of bottom organisms than other stream sections.
<b>Rill</b>	A small intermittent watercourse with steep sides, usually only a few inches deep. Often rills are caused by an increase in surface water flow when soil is cleared of vegetation.

<b>Riprap</b>	A facing layer or protective mound of rocks placed to prevent erosion or sloughing of a structure or embankment due to flow of surface and stormwater runoff.
<b>Riparian</b>	Pertaining to the banks of streams, wetlands, lakes, or tidewater.
<b>Riser</b>	A vertical pipe extending from the bottom of a pond BMP that is used to control the discharge rate from a BMP for a specified design storm.
<b>Road Related Project</b>	A project whose objective is the construction or maintenance of a road. Roads built as a requirement for permit issuance are not included in this category.
<b>Rodenticide</b>	A substance used to destroy rodents.
<b>Runoff</b>	Water originating from rainfall and other precipitation that is found in drainage facilities, rivers, streams, springs, seeps, ponds, lakes and wetlands as well as shallow groundwater. As applied in this manual, it also means the portion of rainfall or other precipitation that becomes surface flow and interflow.
<b>SCS</b>	Soil Conservation Service (now the Natural Resources Conservation Service), U.S. Department of Agriculture
<b>SCS Method</b>	A single-event hydrologic analysis technique for estimating runoff based on the Curve Number method. The Curve Numbers are published by NRCS <i>in Urban Hydrology for Small Watersheds, 55 TR, June 1976</i> . With the change in name to the Natural Resource Conservation Service, the method may be referred to as the NRCS Method.
<b>SEPA</b>	See State Environmental Policy Act.
<b>Salmonid</b>	A member of the fish family <u>Salmonidae</u> . Chinook, coho, chum, sockeye and pink salmon; cutthroat, brook, brown, rainbow, and steelhead trout; Dolly Varden, kokanee, and char are examples of salmonid species.
<b>Sand filter</b>	A man-made depression or basin with a layer of sand that treats stormwater as it percolates through the sand and is discharged via a central collector pipe
<b>Saturation point</b>	In soils, the point at which a soil or an aquifer will no longer absorb any amount of water without losing an equal amount.
<b>Scour</b>	Erosion of channel banks due to excessive velocity of the flow of surface and stormwater runoff.
<b>Sediment</b>	Fragmented material that originates from weathering and erosion of rocks or unconsolidated deposits, and is transported by, suspended in, or deposited by water.
<b>Sedimentation</b>	The depositing or formation of sediment.

<b>Sensitive emergent vegetation communities</b>	Assemblages of erect, rooted, herbaceous vegetation, excluding mosses and lichens, at least some of whose members have relatively narrow ranges of environmental requirements, such as hydroperiod, nutrition, temperature, and light. Examples include fen species such as sundew and, as well as a number of species of Carex (sedges).
<b>Sensitive life stages</b>	Stages during which organisms have limited mobility or alternatives in securing the necessities of life, especially including reproduction, rearing, and migration periods.
<b>Sensitive scrub-shrub vegetation communities</b>	Assemblages of woody vegetation less than 6 meters in height, at least some of whose members have relatively narrow ranges of environmental requirements, such as hydroperiod, nutrition, temperature, and light. Examples include fen species such as Labrador tea, bog laurel, and cranberry.
<b>Settleable solids</b>	Those suspended solids in stormwater that separate by settling when the stormwater is held in a quiescent condition for a specified time.
<b>Sheet erosion</b>	The relatively uniform removal of soil from an area without the development of conspicuous water channels.
<b>Sheet flow</b>	Runoff that flows over the ground surface as a thin, even layer, not concentrated in a channel.
<b>Shoreline development</b>	The proposed project as regulated by the Shoreline Management Act. Usually the construction over water or within a shoreline zone (generally 200 feet landward of the water) of structures such as buildings, piers, bulkheads, and breakwaters, including environmental alterations such as dredging and filling, or any project which interferes with public navigational rights on the surface waters.
<b>Short circuiting</b>	The passage of runoff through a BMP in less than the design treatment time.
<b>Siltation</b>	The process by which a river, lake, or other waterbody becomes clogged with sediment. Silt can clog gravel beds and prevent successful salmon spawning.
<b>Site</b>	The legal boundaries of a parcel or parcels of land that is (are) subject to new development or redevelopment. For road projects, the length of the project site and the right-of-way boundaries define the site.

<b>Slope</b>	Degree of deviation of a surface from the horizontal; measured as a numerical ratio, percent, or in degrees. Expressed as a ratio, the first number is the horizontal distance (run) and the second is the vertical distance (rise), as 2:1. A 2:1 slope is a 50 percent slope. Expressed in degrees, the slope is the angle from the horizontal plane, with a 90° slope being vertical (maximum) and 45° being a 1:1 or 100 percent slope.
<b>Sloughing</b>	The sliding of overlying material. It is the same effect as caving, but it usually occurs when the bank or an underlying stratum is saturated or scoured.
<b>Soil</b>	The unconsolidated mineral and organic material on the immediate surface of the earth that serves as a natural medium for the growth of land plants. See also topsoil, engineered soil/ landscape system, and properly functioning soil system.
<b>Soil group, hydrologic</b>	A classification of soils by the Soil Conservation Service into four runoff potential groups. The groups range from A soils, which are very permeable and produce little or no runoff, to D soils, which are not very permeable and produce much more runoff.
<b>Soil horizon</b>	A layer of soil, approximately parallel to the surface, which has distinct characteristics produced by soil-forming factors.
<b>Soil profile</b>	A vertical section of the soil from the surface through all horizons, including C horizons.
<b>Soil structure</b>	The relation of particles or groups of particles which impart to the whole soil a characteristic manner of breaking; some types are crumb structure, block structure, platy structure, and columnar structure.
<b>Soil permeability</b>	The ease with which gases, liquids, or plant roots penetrate or pass through a layer of soil.
<b>Soil stabilization</b>	The use of measures such as rock lining, vegetation or other engineering structures to prevent the movement of soil when loads are applied to the soil.
<b>Soil Texture Class</b>	The relative proportion, by weight, of particle sizes, based on the USDA system, of individual soil grains less than 2 mm equivalent diameter in a mass of soil. The basic texture classes in the approximate order of increasing proportions of fine particles include: sand, loamy sand, sandy loam, loam, silt loam, silt, clay loam, sandy clay, silty clay, and clay.
<b>Sorption</b>	The physical or chemical binding of pollutants to sediment or organic particles.

<b>Source control BMP</b>	A structure or operation that is intended to prevent pollutants from coming into contact with stormwater through physical separation of areas or careful management of activities that are sources of pollutants. This manual separates source control BMPs into two types. <i>Structural source control BMPs</i> are physical, structural, or mechanical devices or facilities that are intended to prevent pollutants from entering stormwater. <i>Operational BMPs</i> are non-structural practices that prevent or reduce pollutants from entering stormwater. See Volume 4 for details.
<b>Spill control device</b>	A Tee section or turn down elbow designed to retain a limited volume of pollutant that floats on water, such as oil or antifreeze. Spill control devices are passive and must be cleaned-out for the spilled pollutant to actually be removed.
<b>Spillway</b>	A passage such as a paved apron or channel for surplus water over or around a dam or similar obstruction. An open or closed channel, or both, used to convey excess water from a reservoir. It may contain gates, either manually or automatically controlled, to regulate the discharge of excess water.
<b>State Environmental Policy Act (SEPA) RCW 43.21C</b>	The Washington State law intended to minimize environmental damage. SEPA requires that state agencies and local governments consider environmental factors when making decisions on activities, such as development proposals over a certain size and comprehensive plans. As part of this process, environmental documents are prepared and opportunities for public comment are provided.
<b>Steep slope</b>	<p>Slopes of 40 percent gradient or steeper within a vertical elevation change of at least ten feet. A slope is delineated by establishing its toe and top, and is measured by averaging the inclination over at least ten feet of vertical relief. For the purpose of this definition:</p> <p>The toe of a slope is a distinct topographic break in slope that separates slopes inclined at less than 40% from slopes 40% or steeper. Where no distinct break exists, the toe of a steep slope is the lower-most limit of the area where the ground surface drops ten feet or more vertically within a horizontal distance of 25 feet; AND</p> <p>The top of a slope is a distinct topographic break in slope that separates slopes inclined at less than 40% from slopes 40% or steeper. Where no distinct break exists, the top of a steep slope is the upper-most limit of the area where the ground surface drops ten feet or more vertically within a horizontal distance of 25 feet.</p>
<b>Storage routing</b>	A method to account for the attenuation of peak flows passing through a detention facility or other storage feature.

<b>Storm drains</b>	The enclosed conduits that transport surface and stormwater runoff toward points of discharge (sometimes called storm sewers).
<b>Storm drain system</b>	Refers to the system of gutters, pipes, streams, or ditches used to carry surface and stormwater from surrounding lands to streams, lakes, or Puget Sound.
<b>Storm frequency</b>	The time interval between major storms of predetermined intensity and volumes of runoff for which storm sewers and other structures are designed and constructed to handle hydraulically without surcharging and backflooding, e.g., a 2-year, 10-year or 100-year storm.
<b>Storm sewer</b>	A sewer that carries stormwater and surface water, street wash and other wash waters or drainage, but excludes sewage and industrial wastes. Also called a storm drain.
<b>Stormwater</b>	That portion of precipitation that does not naturally percolate into the ground or evaporate, but flows via overland flow, interflow, pipes and other features of a stormwater drainage system into a defined surface waterbody, or a constructed infiltration facility.
<b>Stormwater drainage system</b>	Constructed and natural features which function together as a system to collect, convey, channel, hold, inhibit, retain, detain, infiltrate, divert, treat or filter stormwater.
<b>Stormwater facility</b>	A constructed component of a stormwater drainage system, designed or constructed to perform a particular function, or multiple functions. Stormwater facilities include, but are not limited to, pipes, swales, ditches, culverts, street gutters, detention ponds, retention ponds, constructed wetlands, infiltration devices, catch basins, oil/water separators, and biofiltration swales.
<b>Stormwater Management Manual for Western Washington (Stormwater Manual)</b>	The manual prepared by Ecology which contains BMPs to prevent, control or treat pollution in stormwater and reduce other stormwater-related impacts to waters of the State. The Stormwater Manual is intended to provide guidance on measures necessary in western Washington to control the quantity and quality of stormwater runoff from new development and redevelopment. This manual is equivalent to the Ecology manual and must be used for projects located within the City of Tacoma.
<b>Stormwater Program</b>	Either the Basic Stormwater Program or the Comprehensive Stormwater Program (as appropriate to the context of the reference) called for under the Puget Sound Water Quality Management Plan

<b>Stormwater Site Plan</b>	The comprehensive report containing all of the technical information and analysis necessary for regulatory agencies to evaluate a proposed new development or redevelopment project for compliance with stormwater requirements. Contents of the Stormwater Site Plan will vary with the type and size of the project, and individual site characteristics. It includes a Construction Stormwater Pollution Prevention Plan (Construction SWPPP) and a Permanent Stormwater Control Plan (PSC Plan). Guidance on preparing a Stormwater Site Plan is contained in Volume 1, Chapter 4.
<b>Stream gauging</b>	The quantitative determination of stream flow using gages, current meters, weirs, or other measuring instruments at selected locations. See Gauging station.
<b>Streambanks</b>	The usual boundaries, not the flood boundaries, of a stream channel. Right and left banks are named facing downstream.
<b>Streams</b>	Those areas where surface waters flow sufficiently to produce a defined channel or bed. Lands and waters contained within a channel which supports hydrophytes and where the substrate is predominantly undrained hydric soils, nonsoil and/or is saturated with water or covered by water each growing season. The channel or bed need not contain water year-round. This definition is not meant to include irrigation ditches, canals, stormwater runoff devices or other entirely artificial watercourses unless they are used to convey streams naturally occurring prior to construction. Those topographic features that resemble streams but have no defined channels (i.e. swales) shall be considered streams when hydrologic and hydraulic analyses done pursuant to a development proposal predict formation of a defined channel after development.
<b>Structure</b>	Any manmade item. Examples include catch basins, manholes, buildings, decks, etc.
<b>Structural source control BMPs</b>	Physical, structural, or mechanical devices or facilities that are intended to prevent pollutants from entering stormwater. Structural source control BMPs typically include: <ul style="list-style-type: none"> <li>• Enclosing and/or covering the pollutant source (building or other enclosure, a roof over storage and working areas, temporary tarp, etc.).</li> <li>• Segregating the pollutant source to prevent run-on of stormwater, and to direct only contaminated stormwater to appropriate treatment BMPs.</li> </ul>
<b>Stub-out</b>	A short length of pipe provided for future connection to a storm drainage system.
<b>Subbasin</b>	A drainage area that drains to a water-course or waterbody named and noted on common maps and which is contained within a basin.



<b>Subcatchment</b>	A subdivision of a drainage basin (generally determined by topography and pipe network configuration).
<b>Subdrain</b>	A pervious backfilled trench containing stone or a pipe for intercepting groundwater or seepage.
<b>Subgrade</b>	A layer of stone or soil used as the underlying base for a BMP.
<b>Subsoil</b>	The B horizons of soils with distinct profiles. In soils with weak profile development, the subsoil can be defined as the soil below the plowed soil (or its equivalent of surface soil), in which roots normally grow. Although a common term, it cannot be defined accurately. It has been carried over from early days when "soil" was conceived only as the plowed soil and that under it as the "subsoil."
<b>Substrate</b>	The natural soil base underlying a BMP.
<b>Surcharge</b>	The flow condition occurring in closed conduits when the hydraulic grade line is above the crown of the sewer.
<b>Surface and stormwater</b>	Water originating from rainfall and other precipitation that is found in drainage facilities, rivers, streams, springs, seeps, ponds, lakes, and wetlands as well as shallow groundwater.
<b>Surface and stormwater management system</b>	Drainage facilities and any other natural features that collect, store, control, treat and/or convey surface and stormwater.
<b>Suspended solids</b>	Organic or inorganic particles that are suspended in and carried by the water. The term includes sand, mud, and clay particles (and associated pollutants) as well as solids in stormwater.
<b>Swale</b>	A shallow drainage conveyance with relatively gentle side slopes, generally with flow depths less than one foot.
<b>TMC</b>	Tacoma Municipal Code
<b>Terrace</b>	An embankment or combination of an embankment and channel across a slope to control erosion by diverting or storing surface runoff instead of permitting it to flow uninterrupted down the slope.
<b>Threshold Discharge Area</b>	<p>An onsite area draining to a single natural or constructed discharge location or multiple natural discharge locations that converge within one-quarter mile downstream (as determined by the shortest flowpath). The examples in Figure G - 1 illustrate this definition.</p> <p>The purpose of this definition is to clarify how the thresholds of this manual are applied to project sites with multiple discharge points.</p>

## Chapter 2 Roof Downspout Controls

### 2.1 Description

This section presents the criteria for design and implementation of roof downspout controls. *Roof downspout controls* are simple pre-engineered designs for infiltrating and/or dispersing runoff from roof areas for the purposes of increasing opportunities for groundwater recharge and reduction of runoff volumes from new development or redevelopment. This chapter may also be applicable for onsite management of other impervious surfaces, as allowed by Environmental Services.

This chapter provides guidance for roof downspout controls for meeting the intent of Minimum Requirement #5, Onsite Stormwater Management. It may be possible to use this guidance for meeting the intent of Minimum Requirement #7 as well. Environmental Services may require additional soils or site information for larger projects when using the guidance in this chapter.

Roof downspout controls are used in conjunction with, and in addition to, any additional flow control facilities that may be necessary to mitigate stormwater impacts from the overall development. Implementation of roof downspout controls may reduce the total effective impervious area and result in less runoff from these surfaces. Flow credits for implementing infiltration and dispersion for controls are available as follows:

- If all the roof runoff is infiltrated according to the requirements of this section, the roof area may be discounted from the total project area used for determining flow control thresholds and sizing stormwater facilities.
- If roof runoff is dispersed according to the requirements of this section on lots greater than 22,000 square feet and the vegetative flow path<sup>1</sup> is 50 feet or longer through undisturbed native landscape or lawn/landscape area that meets BMP L613, the roof area may be modeled as grassed surface.

Additional information on flow credits is available in Volume 6, Chapter 2.

**NOTE:** Flow credits only apply to flow control thresholds. Flow credits do not apply to water quality thresholds.

### 2.2 Selection of Roof Downspout Controls

Per Minimum Requirement #5, Onsite Stormwater Management, all projects shall employ roof downspout controls to infiltrate, disperse and retain stormwater onsite to the maximum extent practicable. The applicant is required to control downspouts in the following order of preference:

- Rain gardens (Section 2.4) or Downspout infiltration systems (Section 2.6)
- Downspout dispersion systems (Section 2.7) - only allowed if it can be demonstrated that infiltration is not feasible.
- Collect and convey to the City system (Section 2.8) - only allowed if it can be demonstrated that infiltration and dispersion are not feasible.

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1. *Vegetative flow path* is measured from the downspout or dispersion system discharge point to the downstream property line, stream, wetland, or other impervious surface.

### 2.6.1.1 Design Criteria for Infiltration Trenches

Figure 3 - 1 shows a typical downspout infiltration trench system, and Figure 3 - 2 presents an alternative infiltration trench system for sites with coarse sand and cobble soils. Applicants may use either of these designs in conjunction with the soils table below or may model the site separately. Modeling must be conducted by a licensed engineer in the State of Washington.

#### General

1. The following minimum lengths (in linear feet [LF]) per 1,000 square feet of roof area based on soil type may be used for sizing downspout infiltration trenches. For soil types other than those presented in Table 3 - 5, additional geotechnical information and/or engineering analysis may be required by Environmental Services.

**Table 3 - 5: Downspout Infiltration Length for USDA Soil Type**

USDA Soil Type	Trench Length (linear feet)
Coarser	20
Sand	30
Loamy Sand	75
Sandy Loam	125
Loam	190
Silt Loam	270

2. Maximum length of trench must not exceed 100 feet from the inlet sump.
3. Minimum spacing between trenches shall be 4 feet measured from the edge of trench.
4. Non-woven geotextile fabric shall be placed around the walls, bottom and top of the trench aggregate. A 6-inch minimum layer of sand may be used as a filter media at the bottom of the trench instead of the geotextile. Volume 5, Appendix C contains specifications for geotextile fabric.
5. A minimum of three feet of separation is required from the proposed final grade to the seasonal high groundwater table.
6. A minimum of 1 foot of separation is required from the bottom of the infiltration trench to the seasonal high groundwater table.
7. Infiltration trenches may be placed in fill material if the fill is placed and compacted under the direct supervision of a geotechnical engineer or professional civil engineer with geotechnical expertise, and if the measured infiltration rate is at least 8 inches per hour. Trench length in fill must be 60 linear feet per 1,000 square feet of roof area. Infiltration rates can be tested using the methods described in Section 6.4.3.
8. Trenches may be located under pavement if a small yard drain or catch basin with grate cover is placed at the end of the trench pipe such that overflow would occur out of the catch basin at an elevation at least one foot below that of the pavement, and in a location which can accommodate the overflow without creating a significant adverse impact to downhill properties or drainage systems. This is intended to prevent saturation of the pavement in the event of system failure.